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Supplement to original submittal to EPA for SIP change

Eli Lilly and Company
Indianapolis, Indiana

CP 097-3341
Plt. ID 097-00072
Review Engineer: Dr. T.P.Sinha

Gas stream flow rate, G	= 109.85 lb/hr	$M_{we} * G_{mol}$
Abscissa, ABS	= 0.058	$L/G * (D_g/D_1)^2$
Ordinate, ORD	= 0.14	Read from Figure 4.7-2
Gas flow at flooding, Gaf	= 0.874 lb/h	$[ORD * D_g * D_1 * G_c / ((a/e^3) * (U_1^{0.2}))]^{0.5}$
Gas flow, Ga	= 0.524 lb/hr	$f * G_{af}$
Area of column, Acol	= 0.06 ft ²	$G / (3,600 * G_a)$
Diameter of column	= 1.00 ft	$1.13 * A_{col}^{0.5}$
# Gas trans. units, Nog	= 2	Equation 4.7-13, HAP Manual
Liquid flow rate, L"	= 2025 lb/hr-ft ²	L/A_{col}
Ht of gas transfer unit, Hg	= 3.048 ft	$[b * (3600 * G_a)^c / (L''^d)] * S_{cg}$
Ht of Liq transfer unit, Hl	= 1.63 ft	$Y * (L''/U_1'')^S * S_{cl}^{0.5}$
Ht of transfer unit, Hog	= 4.07 ft	$H_g + (1/AF) * H_l$
Column Height, Htcol	= 8.1 ft	$Nog * Hog$
Total column height, Httot	= 10.4 ft	$H_{T_{col}} + 2 + 0.25 * D_{col}$
Volume of packing material, Vpack	= 6.4 ft ³	

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Pressure drop
through column,
Pa = 2.74 lb/ft²-ft

Total pressure
drop, Ptot = 4.28 in H₂O Pa * HT_{col}/5.2

CAPITAL COSTS

DIRECT COSTSPurchased equipment costs

Absorber Tower
Capital Cost, RCC = \$4,967 From Figure 4.7-4, corrected to
April, 1992 dollars

Auxiliary Equipment
Cost, AEC = \$99,500 Parameter

Packing material,
PM = \$86 Vpack * Pcost, corrected to April,
1992 dollars

Total Equipment
Cost, A = \$ (RCC + AEC + PM)
= \$104,553

Instrumentation,
cost, I = 0.10 * A
= \$10,455

Sales Taxes, S = 0.05 A
= \$5,228

Freight, F = 0.05 * A
= \$5,228

Purchased
Equipment
Costs, B = \$ (A + I + S + F)
= \$ 125,464

Direct Installation Costs

Foundation and
Supports = 0.012 B
= \$15,056

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Handling and Erection	= 0.4 B = \$50,185
Electrical	= 0.01 B = \$1,255
Piping	= 0.03 B = \$37,639
Insulation for ductwork	= 0.01 B = \$1,255
Painting	= 0.01B = \$1,255
Direct Installation Costs, C	= (Foundation and Supports + Handling and Erection + Electrical + Piping + Insulation + Painting) Costs = \$106,644
Site Preparation, D	= \$0
Building Cost, E	= \$0
TOTAL DIRECT COSTS	= \$(B + C + D + E) = \$232,108

INDIRECT COSTS (INSTALLATION)

Engineering	= 0.10 B = \$12,546
Construction and field expense	= 0.10 B = \$12,546
Contractor Fees	= 0.10 B = \$12,546
Start-Up	= 0.01 B = \$1,255

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Performance Test = 0.01 B
= \$1,255

Contingencies = 0.03 B
= \$3,764

TOTAL INDIRECT COSTS = (Engineering + Construction + Contractor Fees
+ Start-Up + Performance Test +
Contingencies) costs
= \$ 43,912

TOTAL CAPITAL INVESTMENT (TCI) = (TOTAL DIRECT COSTS
+ TOTAL INDIRECT COSTS)
= \$(106,664 + 43,912)
= \$ 276,020

DIRECT ANNUAL COSTS

Actual emission stream
flow rate, Q_{ea} = 10 acfm

Annual electricity requirement, F_p = 20 kwh/yr

Annual electricity cost, R_p = \$1 $F_p * U\$Elec$

Annual solvent requirement, Asr = 36,293 gallons

Annual solvent cost, ASC = \$7 $ASR * P_{cw} * 1/1000$

Operating costs

(a) Operating labor costs = \$4,800 $[(0.5 \text{ hr/shift}) / (8 \text{ hr/shift})] * (HRS) * (\$ \text{hourly rate})$

(b) Supervisory Costs = \$720 $0.15 * (\text{Operating labor costs})$

Operating costs = \$(4,800 + 720)